REMARKS

Claims 1 and 26 have been amended to further clarify the invention. Non-elected claims 14-25 have been canceled without prejudice to the filing of continuation applications. New claims 31-37 have been added. Support for new claims 31-32 can be found, for instance, in original claims 1 and 6. Support for the "about 27 μm to about 200 μm" limitation in new claim 33 can be found in the specification, at page 13, line 2-3 (supporting the 27 μm of the range), and page 7, line 8 (supporting the range up to 200 μm). A person of ordinary skill in the art would recognize that in order to pass particles of 5 nm to 200 μm through the channel (indicated on page 7, line 8), the separation between posts would have to be up to 200 μm. Support for the 7 μm of claim 35 can be found in the specification, at page 9, line 18 and support for the up to 200 μm range can be found at page 7, line 8. No new matter is added by the amendments. With the amendments, claims 1-13 and 26-37 are pending.

Applicants hereby bring to the Office's attention copending U.S. application serial number 10/176,322, filed June 20, 2002, and published as pre-grant publication number US2003-0010637A1 ("the '322 application") and copending application number 10/760,139, filed January 16, 2004, and published as US 2004-0211669 A1 ("the '139 application"). The '322 application is a continuation-in-part of the instant application. The '139

application is a continuation-in-part of the '322 application. At least one Office Action on the merits has issued for the '322 application.

Turning to the Office Action, claims 1 and 26 stand objected to because of certain informalities; and claims 1-13 and 26-30 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Cummings et al., Proceedings of SPIE, 164-173 (2000) ("Cummings SPIE article"), and under § 102(a) as being anticipated by WO 01/37958A2 ("Austin").

Applicants respectfully submit that the objection to claims 1 and 26 is addressed by the present claim amendments. Specifically, the phrase "said flow channel" in these claims has been replaced with --said fluid flow channel--, as suggested by the Office. Withdrawal of the rejection is therefore respectfully requested.

The § 102 rejections are addressed below.

Rejection under § 102(b) Based on Cummings

Claims 1-13 and 26-30 stand rejected under § 102(b) as being anticipated by the Cummings SPIE article. Applicants respectfully disagree with the rejection.

The Cummings SPIE article does not constitute 102(b) art to the present application because the reference published less than one year prior to the filing date of the application. The Cummings SPIE article published on or after September 18, 2000.

See International Search Report of International Application PCT/US02/19586, attached as Appendix A.[1] The instant application was filed on June 20, 2001. Therefore, the reference published less than one year prior to the filing date of the present application and as a result does not represent § 102(b). Withdrawal of the 102(b) rejection is respectfully requested.

Rejection under § 102(a) Based on Austin

Claims 1-13 and 26-30 stand rejected under § 102(a) as being anticipated by Austin. Applicants respectfully submit that the claims, as amended, are not anticipated by the reference. As discussed more fully below, in contradistinction to Austin, the claimed apparatus does not suppress electroosmotic flow.

Applicants claim an apparatus for dielectrophoretic separation of particles. The apparatus differs from prior art dielectrophoretic devices in part because it eliminates the need for embedded electrodes. See specification, page 3, lines 15-20. Prior art devices with embedded electrodes cannot be electrokinetically driven without the applied fields interfering with, e.g., being short-circuited by, the embedded electrodes. For this reason, prior art devices use pressure driven flow to convey particles. See specification, page 2, lines 18-22.

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[1] PCT/US02/19586 (publication number WO 03/001193) is the corresponding International Application of the '322 application which, as discussed above, is a continuation-in-part of the instant application.

In contrast to prior art systems, fluid flow in the claimed apparatus can be electrokinetically driven (i.e., driven by an electric field), and the use of pressure driven flow is optional rather than required. As is known to a person of ordinary skill in the art, advantages of electrokinetic flow over pressure driven flow include:

1. Electrokinetic flow obviates the need for an apparatus for producing pressure-driven flow at no additional complexity, since electrodes and a power source already exist to drive dielectrophoresis.

2. In a two-dimensional system like an array of posts, ideal electrokinetic flow produces no depth dispersion, unlike pressure-driven flow, which produces tremendous amounts of depth dispersion. This lack of depth dispersion keeps localized samples from spreading during sample introduction and, more importantly during sample release, in which the ability to maintain a high concentration factor is directly related to the ability to keep the concentrated plug from dispersing upon leaving the dielectrophoretic traps.

3. Ideal electrokinetic flow is irrotational. Pressure-driven flow produces vorticity, which can swirl and mix flows.

Electrokinetic transport in a fluid is a combination of electrophoretic transport and electroosmotic transport.[2] Since flow by electrophoretic transport requires the particle to be charged, or have a non-zero electrophoretic mobility, electrokinetic flow of *uncharged* polarizable particles requires the presence of the electroosmotic component of electrokinetic flow. Suppression of the electroosmotic flow, therefore, means that neither the suspending liquid nor non-charged particles can be moved by electrokinetic flow. As noted above, systems not utilizing electrokinetic flow generally rely on pressure driven flow to move particles having a zero electrophoretic mobility.

Austin describes a microfluidic device for manipulating particles by dielectrophoresis. The device includes constrictions of insulating material for trapping polarizable particles. Austin, page 1, lines 15-27.

Although the Austin device does not utilize embedded electrodes, the device nevertheless resembles prior art dielectrophoretic systems in that fluid flow through the device is not driven by electroosmosis. For instance, for a sample having a net charge and a non-zero electrophoretic mobility, Austin indicates that a DC field is used to feed the sample into

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[2] See J.I. Molho et al., "Fluid Transport Mechanisms in Microfluidic Devices", Micro-Electro-Mechanical Systems (MEMS), *1998 ASME International Mechanical Engineering Congress and Exposition* (DSC-Vol.66), second page, left column ("Molho") (available at http://mems.stanford.edu/~aeh/publications/Molho_asme98.pdf, and attached as Appendix B); see also the Cummings SPIE

the device's dielectrophoretic traps. Austin, page 23, lines 11-13. For non-charged particles or particles having a zero electrophoretic mobility, an applied pressure or a syringe pump is used for feeding sample into the traps. Austin, page 23, lines 15-18.

Importantly, Austin does not mention, and therefore does not contemplate, movement of sample by electrokinetic transport having an electroosmotic flow component. No mention is made in the reference of electrokinetic flow. Rather, throughout the document, sample flow is described as electrophoretic or pressure driven or syringe driven. See, for example, Austin, page 16, lines 23-25, page 23, lines 6-23.

Indeed, in its working examples, Austin explicitly teaches the suppression of the electroosmotic flow component of electrokinetic transport. See page 31, Example 1. It follows, therefore, that Austin actually inhibits the electroosmotic flow component of electrokinetic flow, relying instead on pressure/syringe driven flow or pure electrophoresis, as discussed above. Therefore, Austin teaches away from the use of electroosmotic flow.

Austin's suppression of electroosmotic flow is an important difference between the Austin device and the claimed apparatus, which does not inhibit the electroosomotic component

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article, p.165, equation (4).

of electrokinetic flow. To clarify this difference, Applicants have amended the claims to indicate that electroosmotic flow is not suppressed.

The use of electrokinetic flow rather than exclusive pressure/syringe driven flow improves selectivity and reduces hydrodynamic dispersion of analytes. See specification, page 3, lines 1-2. Moreover, devices that employ electroosomotic flow in addition to electrophoretic flows are demonstrably superior to devices that employ purely electrophoretic flows, Such as Austin's device. For instance, these advantages include:

1. The extra step of blocking electroosmotic flow (EOF) adds manufacturing or operating complexity and may make such devices difficult to integrate with other devices that utilize EOF or are otherwise incompatible with the chemicals used to suppress EOF. The native surfaces of nearly all insulating materials support EOF, so suppressing EOF nearly always involves special treatments.
2. EOF is preferred over purely electrophoretic flow because EOF can prevent the build up of electrochemical products and associated local changes in pH, conductivity, and fluid composition that can reduce selectivity, produce drift in the response of the dielectrophoretic filters, and harm living cells.

3. The electrophoretic mobility of most biological particles is low compared to the electroosmotic mobility of many glass and plastic surfaces, thus the throughput of purely electrophoresis-driven devices is typically dramatically lower than that of electrokinesis-driven devices.

4. Having an EOF component helps to improve the stability of high-flow-rate dielectrophoretic selective concentrators.

In summary, Austin explicitly suppresses the electroosmotic flow component of electrokinetic transport, and therefore teaches away from the use of general electrokinetic transport. In contrast, the claimed invention does not suppress electroosmotic flow. Consequently, the present claims are not anticipated by the reference. Withdrawal of the § 102(a) rejection is respectfully requested.

New Claims 31-32 are Also Allowable

New claims 31-32 are directed to an apparatus wherein the insulating structures are circular posts. The dielectric constrictions described in Austin contain angled edges. Austin, page 11, lines 14-17. Such geometries are preferred by Austin. Austin, page 11, lines 14-16. All of the dielectric constrictions disclosed in Austin have angled edges. See page 11, lines 16-17. Austin, therefore, does not disclose the

circular posts of new claims 31-32 and indeed teaches away from such posts. Accordingly, claims 31-32 are allowable over Austin.

New Claims 33-35 are Also Allowable

New claims 33-35 are directed to an apparatus wherein adjacent insulating structures are separated by about 27 µm to about 200 µm. The width of the constrictions in Austin's device is between 0.1 µm and 5.0 µm. Austin, page 11, line 23. Claims 33-35 are also allowable over Austin.

New Claims 36-37 are Also Allowable

New claims 36-37 are directed to an apparatus wherein the insulating structures are square posts having sides that are parallel to the fluid flow channel. The dielectric constrictions described in Austin contain angled edges. Austin, page 11, lines 14-17. In addition, Austin's edges are angled toward the constriction. See Austin, for example Fig. 1A and accompanying description at page 11, lines 8-18. Austin, therefore, does not disclose square posts having sides parallel to the flow channel, as claimed in new claims 36-37. Accordingly, new claims 36-37 are allowable over Austin.

Allowance of all the claims and passage of the application to issue are respectfully requested. Applicants urge the Examiner to contact Applicants' undersigned representative at

(312) 913-0001 if the Examiner believes that this would expedite prosecution of this application.

Respectfully submitted,

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